

L2MU: Status Report

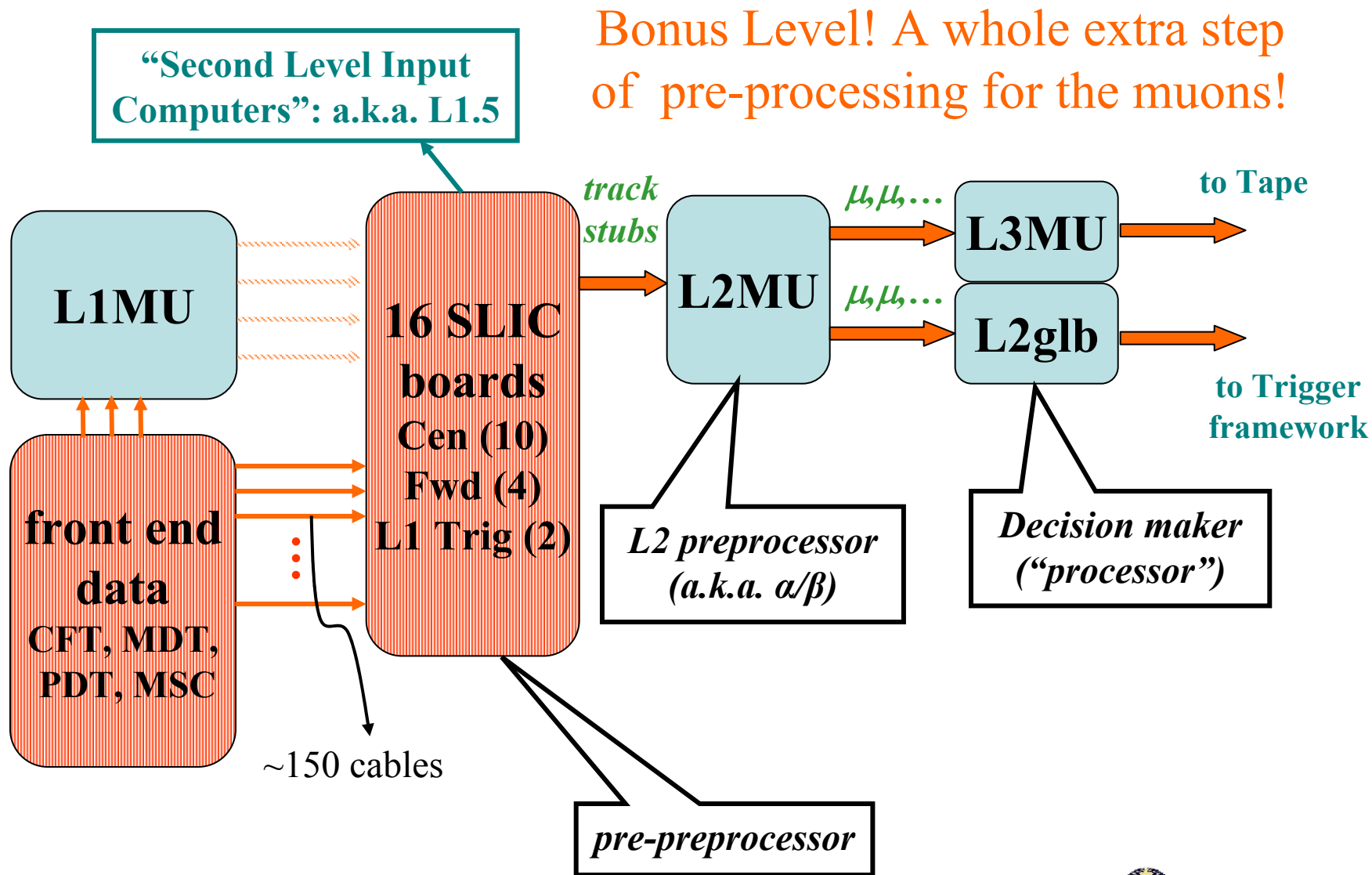
Christos Leonidopoulos,
for the L2MU group



Columbia University

- History
- Performance
- Stability
- Tools - Monitoring
- Simulator
- Future

What is L2MU? (not what you may think...)

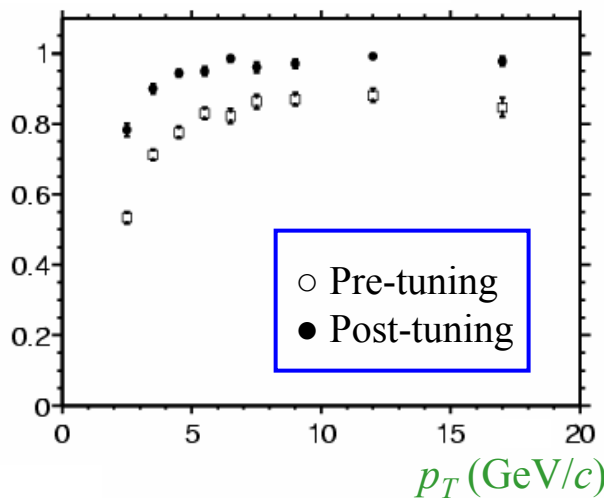


A little history

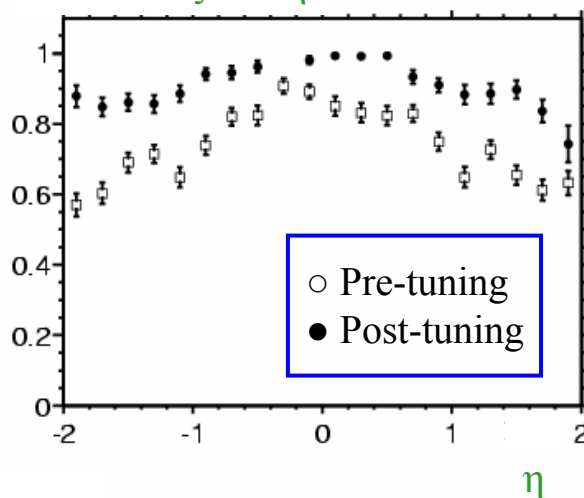
- May'02: Started filtering!
 - The first L2 module to go on-line!
 - Jun'02: “Teething” problems
 - Stability issues: driver, monitoring, algorithms
 - Learning to deal with problematic FE muon inputs
 - Sep'02: New LUT (and the next crisis)
 - Fwd SLIC algorithm problems tracked down & fixed
 - Additional monitoring, error-log tools developed
 - Feb-Mar'03: New LUT, algorithms tuned-up
 - Another Fwd SLIC algorithm crisis solved
- Today:
L2MU is more
efficient & robust
than ever!

Performance: Efficiency

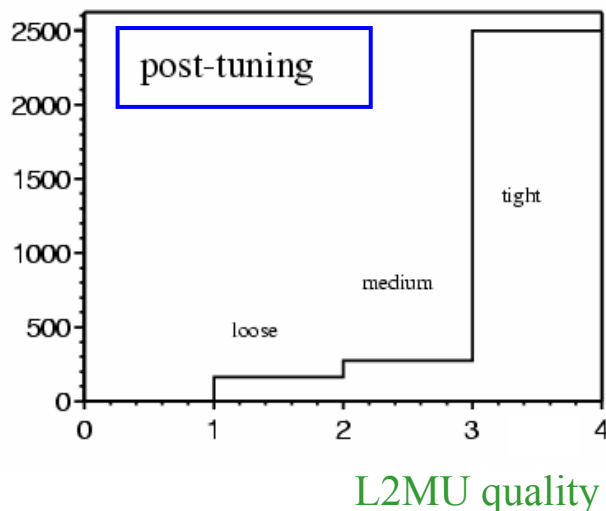
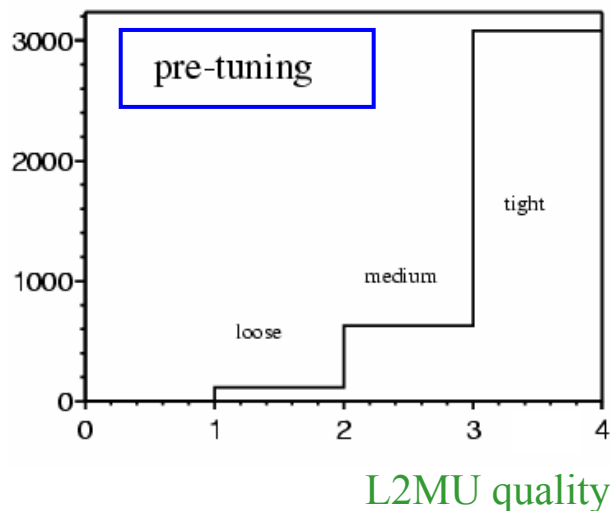
Efficiency vs. off-line p_T



Efficiency vs. η



Significant
efficiency (*)
improvement
with latest
code revision



(code went on-line
on March 10, 2003
Run # 174094)

(*) Medium (or better)
Muon Candidates
matched to tracks

Performance: Rejection

Trigger	L2 Rejection
<i>Single muons</i>	
MU_A_L2M3_TRK10	3.88 ± 0.03
MU ^W _A_L2M3_TRK10	1.64 ± 0.01
<i>Dimuons</i>	
2MU_A_2L2	8.6 ± 0.1
2MU_A_L2ETAPHI	4.6 ± 0.4
2MU ^W _A_2L2_L3L7	3.47 ± 0.06

Sample numbers
from Run #177887
(June 9, 2003)

Notes:

- L2 rejection is higher for scint-based L1 triggers
- With the addition of **wire hits** at L1, fake L1MU rates are decreased (and so is L2 rejection)
- L1 & L2 now sharing the same inputs (L2: better granularity)

Code stability

- **Driver, Memory Mgmt, monitoring:**
 - Last issues/problems resolved/fixed last July ✓
 - No major code reorganization since
- **Central SLIC algorithms:**
 - Never had any problems ✓
- **Forward SLIC algorithms:** was killed (?) in Feb (*)
 - Old stubborn bug resurrected w/ code revisions
- **Cen & Fwd Alpha algorithms:**
 - Never had any problems ✓



(*) Developed software that captures input data (leading to crashes/hiccups) for off-line study;

We know how to deal with similar problems in the future

Main Entry: **poly·mor·phism**
Pronunciation: "pä-IE-'mor-'fi-z&m
Function: *noun*
Date: 1839
: the quality or state of being able to assume different forms: as **a** : existence of a species in several forms independent of the variations of sex **b** : the property of crystallizing in two or more forms with distinct

UnBiased Sample Mode (*)

(Another side effect of debugging SLIC crashes)

Robustness of UBS functionality (SLIC firmware)
thoroughly tested; SLIC survives ruthless running conditions:

- Running in UBS mode 100% of the time
- HV thresholds lowered: ~ 100 hits/event
(compare to \sim few hits/event in physics runs)
- Went up to 1.2 kHz before front-end busy's
became an issue



(*)

- UBS mode: this is when the input raw data is appended
to the output (along with the triggers found)
- Mark & Pass: all events are recorded
- Typical event size: $\sim \times 10$ larger than normal

On-line Monitoring (1)

	CH	ID	enabled	Evt. occ	Sync Err	Rogue Ch
SLIC 70	Ch 0	SCL	yes	0	0	0
SLIC 70	Ch 1	none	no			
SLIC 70	Ch 2	x89	no			
SLIC 70	Ch 3	x189	no			
SLIC 70	Ch 4	x92	yes	0	47	32
SLIC 70	Ch 5	x94	yes	0	20992	6
SLIC 70	Ch 6	x299	yes	0	55	64
SLIC 70	Ch 7	none	no			
SLIC 70	Ch 8	x82	yes	0	21	0
SLIC 70	Ch 9	x84	yes	0	22	1
SLIC 70	Ch 10	x182	yes	0	1	0
SLIC 70	Ch 11	x184	yes	0	3	0
SLIC 70	Ch 12	x282	yes	0	22	0
SLIC 70	Ch 13	x284	yes	0	20	0
SLIC 70	Ch 14	none	no			
SLIC 70	Ch 15	none	no			

disabled channel

channel about
to be disabled!

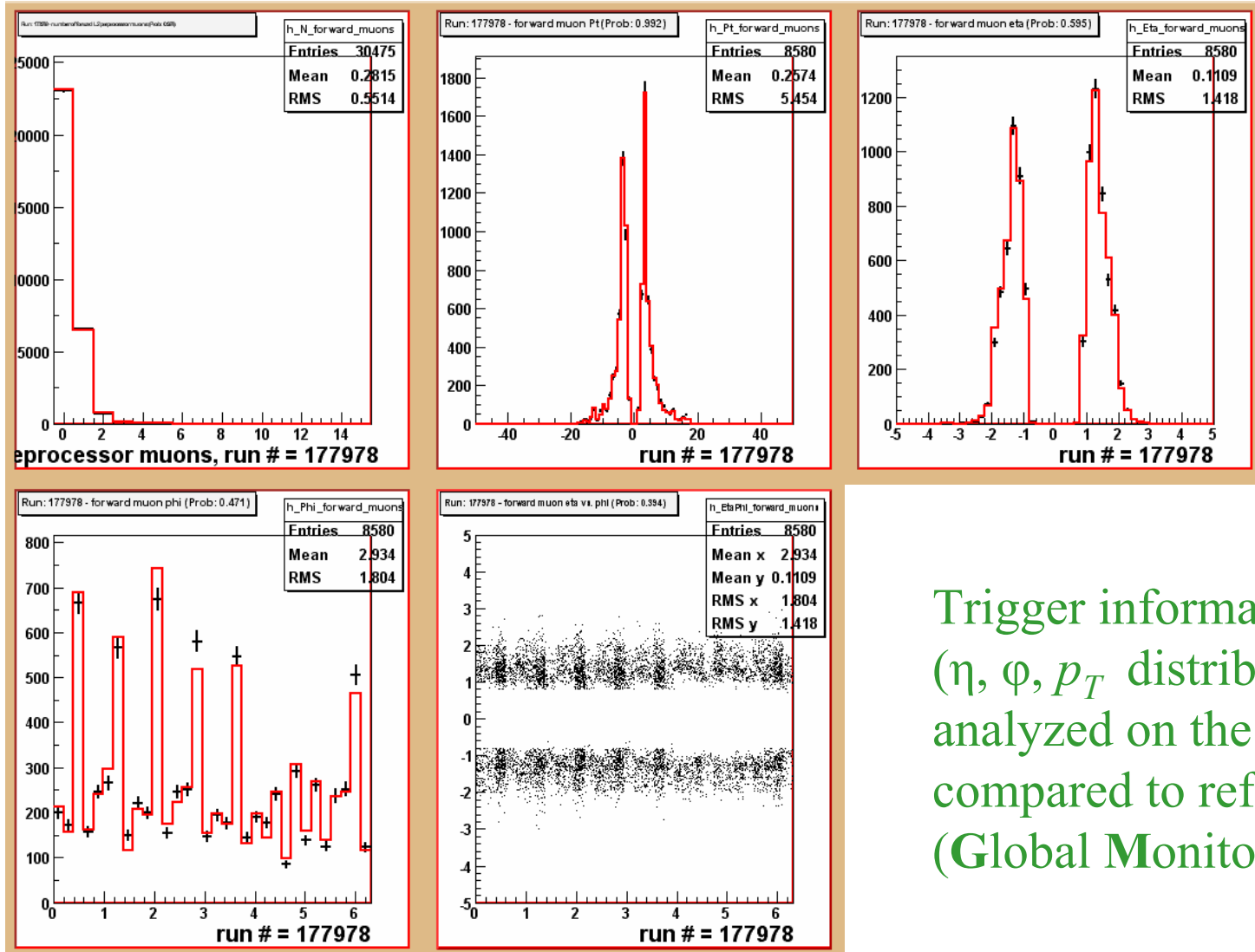
typical rates
for sync errors

Information sent to α by
SLICs every 5 secs via
VME (event occupancies,
errors, timing, etc)

Thanks Reinhard

Impact of monitoring on dead time recently studied: may need to
introduce new monitoring levels w/ less information

On-line Monitoring (2)



Trigger information
(η , ϕ , p_T distributions)
analyzed on the fly &
compared to reference plots
(Global Monitoring)

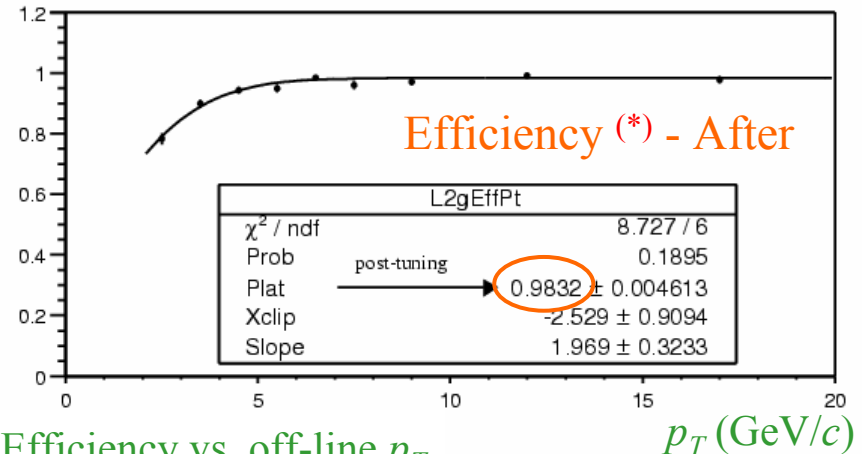
Thanks Joe

Off-line Monitoring

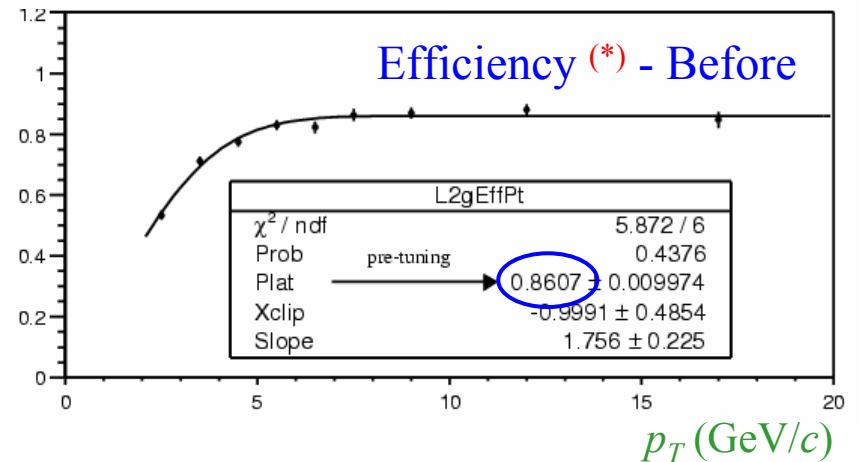
Recently developed software:

- Downloads runs from SAM
- Collects muon-trigger-unbiased events containing off-line muons
- L2MU distributions & trigger performance monitoring w/o requiring special runs

Efficiency vs. off-line p_T



Efficiency vs. off-line p_T



(*) Medium (or better) Muon Candidates matched to tracks

Simulator vs. on-line comparison

Developed software that allows studies on SLIC & alpha code verification separately

- SLIC algorithm verification:

- Difference in muon stub finding: $|N_{\text{online}} - N_{\text{offline}}| \sim 1\text{-}2\%$
- Includes effect due to **SLIC input discrepancies** (inputs in simulator taken & unpacked from L3)
- Further studies pending

- Alpha algorithm verification:

- Difference in muon trigger finding: $|N_{\text{online}} - N_{\text{offline}}| < 0.1\%$
- Source: rounding up of floats (LUT indices)
- Problem can be solved by using integers instead

Other “L2MU” issues

Front-end muon inputs occasionally give problems
(stop sending data, or too many out-of-sync errors)

- Need to be disabled fast (*Alan Stone is watching you*)
- Recently developed GUI:
 - Muon expert can disable L2MU inputs ✓
- No need to page L2 expert any more ;-)



Thanks Dennis, Reinhard

More complaints about L2MU...

Subject: L2 trigger improvement after run ~172k

Date: Mon, 05 May 2003 17:09:32 -0500

From: xxxxxx <xxxxx@fnal.gov>

To: christos@fnal.gov

Hello Christos :

I am trying to calculate Z cross-section for $Z \rightarrow \mu\mu$ and get its time dependence.

My problem is that L2 trigger has improved after run ~172k or so.

Future Plans

Can we increase the L2MU rejection power?

Difficult if relying just on muon hits...

- Match tracks to muons
 - Will need to be implemented at L2GLB (receives inputs from STT & L2MU)
- Can L2MU do a better job in measuring p_T ?
 - Needs ~2 weeks of studies (& “proof of principle”)
 - Need to work w/ muon group to prove that local p_T measurement is better than L2’s